DESCRIPTION

A VOLTAGE BLOCK DEVICE AND AN ELECTROSTATIC COATING SYSTEM WITH THE VOLTAGE BLOCK DEVICE

Technical Field

The present invention relates to an electrostatic coating system, and in particular to a voltage block device used in an electrostatic coating system.

Background Art

In an electrostatic coating system, a negative high voltage is applied to a spray to provide a negative electrode and a coating objective article is grounded to provide a positive electrode, and an electric field is formed therebetween. A coating material is sprayed to the coating objective article after it is negatively charged. Recently, in the field of the electrostatic coating, water-based coating material is increasingly used. When a water-based coating material is used in an electrostatic coating system, a voltage block device is disposed between a coating material source and a spray in order to prevent the voltage applied to the coating material in the spray from passing through the conductive water-based coating material to the coating material source.

Japanese Unexamined Patent Publication (Kokai) No. 6-198228 discloses an example of the voltage block device. However, the voltage block device disclosed in Japanese Unexamined Patent Publication (Kokai) No. 6-198228 comprises separately provided first and second transfer units and a switching valve. The disclosed device is very large and therefore requires large footprint for install the device in a paint shop and an increased production cost.

Disclosure of the Invention

Therefore, the present invention is directed to solve the problems of the voltage block device of the prior art and to provide a compact and efficient voltage block device and an electrostatic coating system including the voltage block device.

In accordance with the present invention, there is provided a voltage block device, used in an electrostatic coating system in which a negative electric potential is applied to a coating material supplied from a coating material source to a spray for spraying the coating material to a coating objective to which a positive electric potential is applied, for preventing the negative electric potential from transferred to the coating material source, comprising;

a switching device including a slider which is selectively slidable between first and second positions and has an inlet port fluidly communicated with the coating material source and an outlet port fluidly communicated with the spray; a reservoir including first and second chambers; the inlet and outlet ports being fluidly communicated with the first and second chambers, respectively when the slider is at the first position; and the inlet and outlet ports being fluidly communicated with the second and first chambers, respectively when the slider is at the second position.

In accordance with another feature of the present invention, there is provided an electrostatic coating system, comprising:

a coating material source; a spray, applied with a negative electric potential, for spraying the coating material from the coating material source to a coating objective, applied with a positive electric potential; and a voltage block device, for preventing the negative electric potential from transferred to the coating material source;

the voltage block device, comprising:

a switching device including a slider which is

selectively slidable between first and second positions and has an inlet port fluidly communicated with the coating material source and an outlet port fluidly communicated with the spray;

a reservoir including first and second chambers; the inlet and outlet ports are fluidly communicated with the first and second chambers, respectively when the slider is at the first position; and the inlet and outlet ports are fluidly communicated with the second and first chambers, respectively when the slider is at the second position.

Brief Description of the Drawings

Figure 1 is a block diagram of an electrostatic coating system according to a preferred embodiment of the invention;

Figure 2 is a schematic illustration showing a first position of a voltage block device according to a first embodiment of the invention;

Figure 3 is a schematic illustration showing the first position of the voltage block device shown in Figure 2;

Figure 4 is a schematic illustration showing a second position of the voltage block device shown in Figure 2;

Figure 5 is a schematic illustration showing the second position of the voltage block device shown in Figure 2;

Figure 6 is a schematic perspective view of a slider of the voltage block device;

Figure 7 is a plan view similar to Figure 2 of a voltage block device according to a second embodiment of the invention; and

Figure 8 is a side view of the voltage block device shown in Figure 7.

Best Mode for Carrying out the Invention

With reference to Figure 1, an electrostatic coating system 10 according to a first embodiment of the present invention comprises a spray 12 to which a negative DC voltage is applied, a tank 16 as a supply source of a water-based paint, first and second pumps 18 and 24 and a voltage block device 26.

The voltage block device 26 comprises a reservoir 28 and a switching device 40. The switching device 40 comprises a valve which includes an inlet port 42, a outlet port 44 and first and second reservoir ports 46 and 48, and can selectively move between a first position and second position. At the first position, the inlet and outlet ports 42 and 44 are fluidly communicated with the first and second reservoir ports 46 and 48, respectively. At the second position, the inlet and outlet ports 42 and 44 are fluidly communicated with the second and first reservoir ports 48 and 46, respectively.

The reservoir 28 has a cylinder, a double headed piston 30 and first and second chambers 32 and 34 defined by the cylinder and the ends of the double headed piston 30. The first and second chambers 32 and 34 are fluidly communicated with the first and second reservoir ports 46 and 48, respectively through the first and second connection conduits 36 and 38.

With reference to Figures 2-6, the voltage block device 26 will be explained in detail below. In this connection, please note that in Figures 2-6, the elements forming the voltage block device 26 are indicated by new reference signs different from those in Figure 1.

The voltage block device 100 comprises a reservoir 110 and a slider 120 made of an insulative material. The slider 120 provides the above-described switching device, and can selectively move between first and second positions, shown in Figures 2 and 3 and Figures 4 and 5, respectively. Further, the slider 120 includes an inlet passage 122, providing the inlet port 42 in Figure 1, and a outlet passage 124, providing the outlet port 44 in

Figure 1. The inlet and outlet passages 122 and 124 are apart from each other in the vertical direction, as shown in Figure 6. The inlet passage 122 is fluidly connected to a coating material source (tank 16 and pump 18) through a flexible conduit 102 and the outlet passage 124 is fluidly connected to a spray (spray 12) through the flexible conduit 104.

The first and second passages 122a and 122b are connected to the inlet passage 122 and third and fourth passages 124a and 124b are connected to the outlet passage 124. Moving quick couplers 126a - 126d are provided at the ends of the first to fourth passages 122a, 122b, 124a and 124b so that the moving quick couplers 126a - 126d are coupled to and decoupled from corresponding stationary quick couplers 132a - 132d in accordance with the position of slider 120.

The stationary quick coupler 132a is fluidly connected to the first chamber of the reservoir 110 through a joint 130a, a conduit 114b, a three-way joint 118a, a conduit 114a and a joint 112a. The stationary quick coupler 132b is fluidly connected to the second chamber of the reservoir 110 through a joint 130b, a conduit 116b, a three-way joint 118b and a conduit 116a and a joint 112b. The stationary quick coupler 132c is fluidly connected to the second chamber of the reservoir 110 through a three-way joint 118b, a conduit 116a and the joint 112b. The stationary quick coupler 132d is fluidly connected to the first chamber of reservoir 110 through a three-way joint 118a, a conduit 114a and the joint 112a.

Stationary shielding members 134a - 134d made of an insulative material are provided to surround the stationary quick couplers 132a - 132d. Moving shielding members 128a - 128d made of an insulative material are mounted to the slider 120 so as to surround the moving quick couplers 126a - 126d. When the slider 120 is at the first position, the moving shielding members 132a and

132c are fitted onto the stationary shielding members 134a and 134c, and the moving shielding members 132b and 132d are decoupled from the stationary shielding members 134b and 134d. On the other hand, when the slider 120 is at the second position, the moving shielding members 132a and 132c are decoupled from the stationary shielding members 134a and 134c, and the moving shielding members 132b and 132d are fitted onto the stationary shielding members 134b and 134d.

When slider 120 is at the first position (Figures 2 and 3), the moving quick coupler 126a is coupled to the stationary quick coupler 132a, and the moving quick coupler 126d is decoupled from the stationary quick coupler 132d whereby the first chamber of reservoir 110 is fluidly connected to the coating material source through the joint 112a, the conduit 114a, the three-way joint 118a, the conduit 114b, the joint 130a, the quick coupler 132a, the quick coupler 126a, the first passage 122a, the inlet passage 122 and the flexible conduit 102, as shown in Figure 2. On the other hand, the moving quick coupler 128c is coupled to the quick stationary coupler 132c, and the quick coupler 126b is decoupled from the quick coupler 132b whereby the second chamber of the reservoir 110 is fluidly connected to the spray through the joint 112b, the conduit 116a, the three-way joint 118b, the quick coupler 132c, the quick coupler 126c, the third passage 124a, the outlet passage 124 and the flexible conduit 104, as shown in Figure 3.

When slider 120 is at the second position (Figures 4 and 5), the moving quick, coupler 126a is decoupled from the stationary quick coupler 132a, and the moving quick coupler 126d is coupled to the stationary quick coupler 132d whereby the first chamber of the reservoir 110 is fluidly connected to the spray through the joint 112a, the conduit 114a, the three-way joint 118a, the quick coupler 132d, the quick coupler 126d, the fourth passage 124b, the outlet passage 124 and the flexible conduit

104, as shown in Figure 4. On the other hand, the moving quick coupler 128c is decoupled from the stationary quick coupler 132c, and the moving quick coupler 126b is coupled to the stationary quick coupler 132b whereby the second chamber of the reservoir 110 is fluidly connected to the coating material source through the joint 112b, the conduit 116a, the three-way joint 118b, the conduit 116b, the quick coupler 132 b, the quick coupler 126b, the second passage 124b, the inlet passage 122 and the flexible conduit 102, as shown in Figure 5.

With reference to Figures 7 and 8, a voltage block device according to a second embodiment of the invention will be described below. The second embodiment is configured substantially the same as the first embodiment, and therefore only the difference between the first and second embodiment will be described below.

In Figures 7 and 8, the voltage block device 200 comprises a mounting plate 202 for mounting the voltage block device 200 to a frame member (not shown) of the electrostatic coating system or to a column of a spray shop where the electrostatic coating system. A base member 204 is secured to the mounting plate 202. A slider 206 similar to the slider 120 is slidably mounted to the base member 204, and can selectively move between the first position and second position similar to the first embodiment.

The second embodiment shown in Figures 7 and 8 is configured substantially the same as the first embodiment, except that the voltage block device 200 comprises additional shielding members 208 and 210. The additional shielding members comprises stationary shielding members 208a and 208b attached to the base member 204 and moving shielding members 210a and 210b attached to the slider 206. Each of the stationary shielding members 208a and 208b includes a recess 209a and 209b for receiving each of the moving shielding members 210a and 210b. When the slider 206 is at the

first position, the stationary shielding member 210a is received in the recess 209a. When the slider 206 is at the second position, the stationary shielding member 210b is received in the recess 209b.